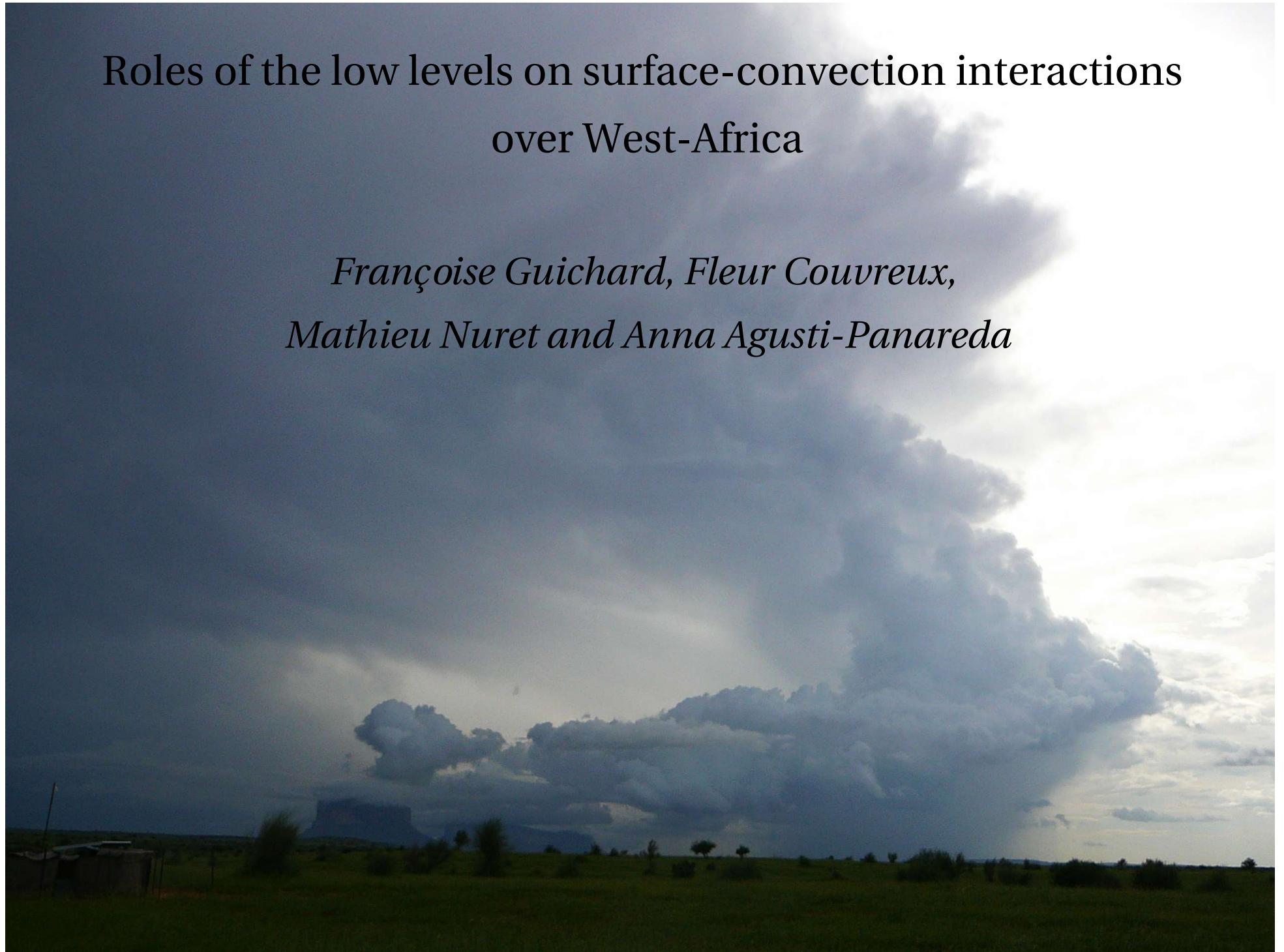
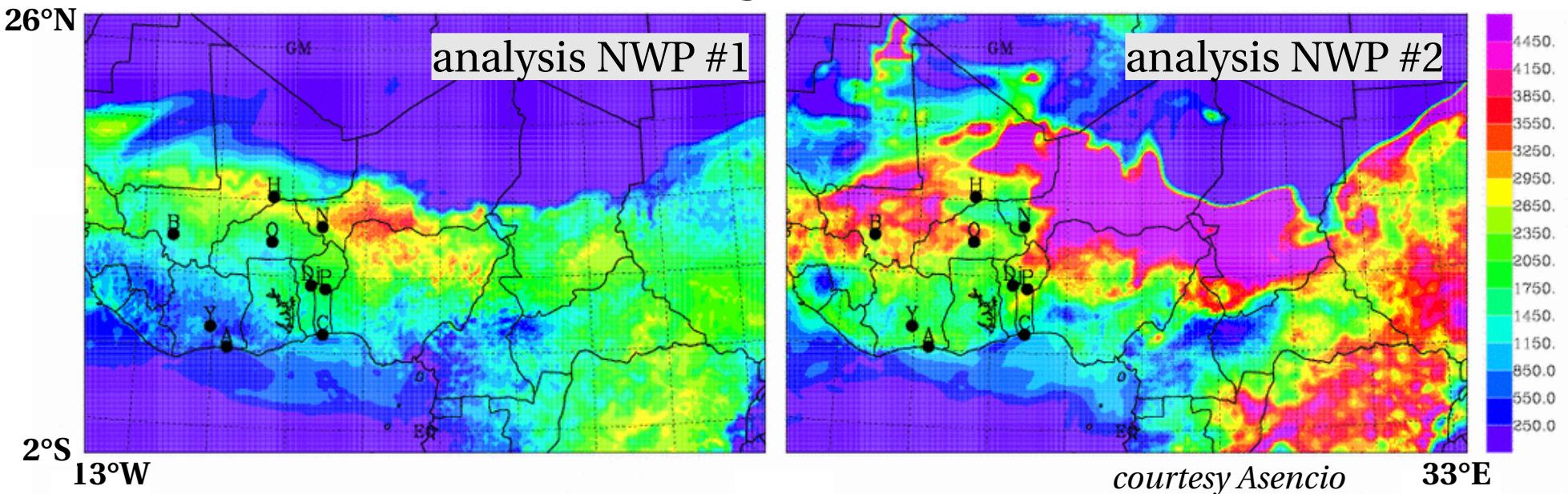


Roles of the low levels on surface-convection interactions over West-Africa

*Françoise Guichard, Fleur Couvreux,
Mathieu Nuret and Anna Agusti-Panareda*



varied depiction of basic “convection-related features” in current NWP analysis...
CAPE



... strongly related to differences in the low atmospheric layers

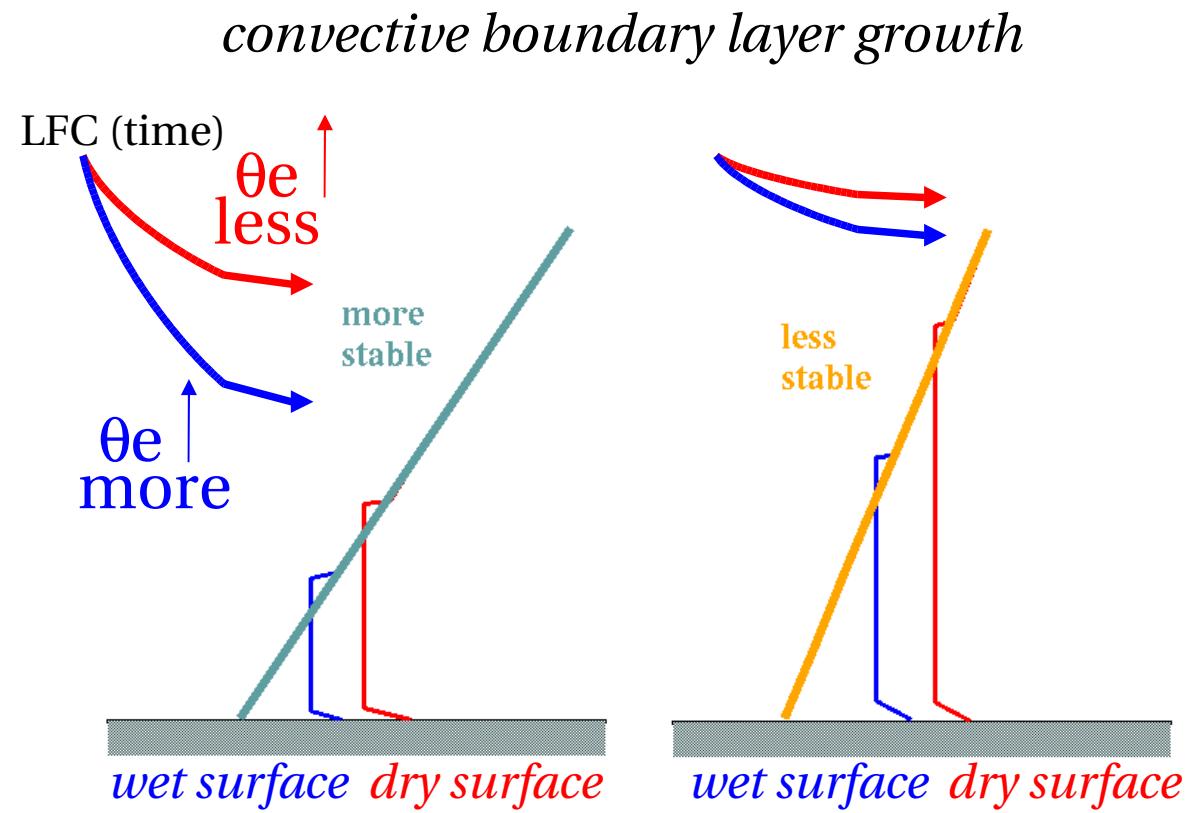
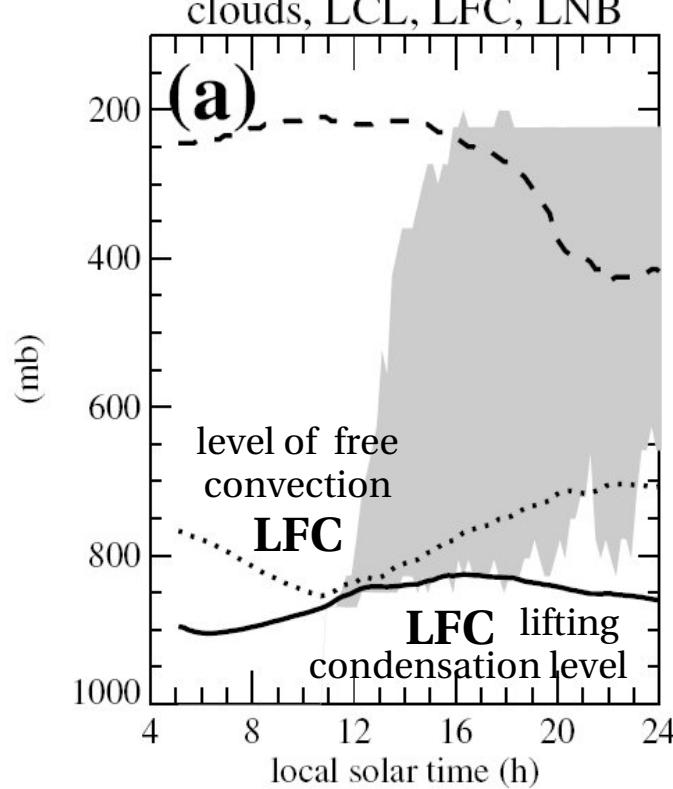
stresses the need for data, data-based studies and model evaluation

aim here :

identify basic low-level thermodynamic/convective features from data

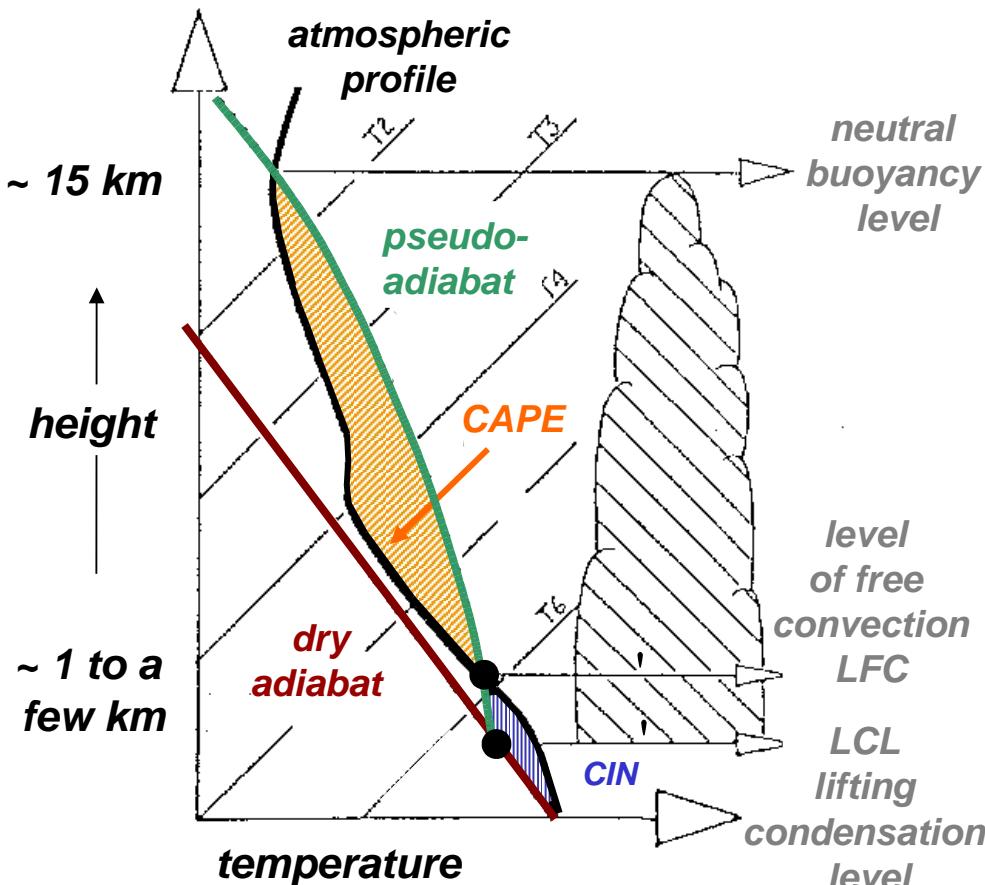
by making use of the several thousands of high-resolution atmospheric soundings collected during AMMA (Parker et al. 2008)

investigate how atmospheric conditions in the low levels (~ 4 1st kms) may or may not play a role in the modes of interaction between the surface and the daytime atmosphere, over a region where surface net radiation can be quite high during the monsoon season and low levels are varied



1D/z daytime convective arguments
shear, advection, cloud shading etc... missing

in combination with classical indexes below



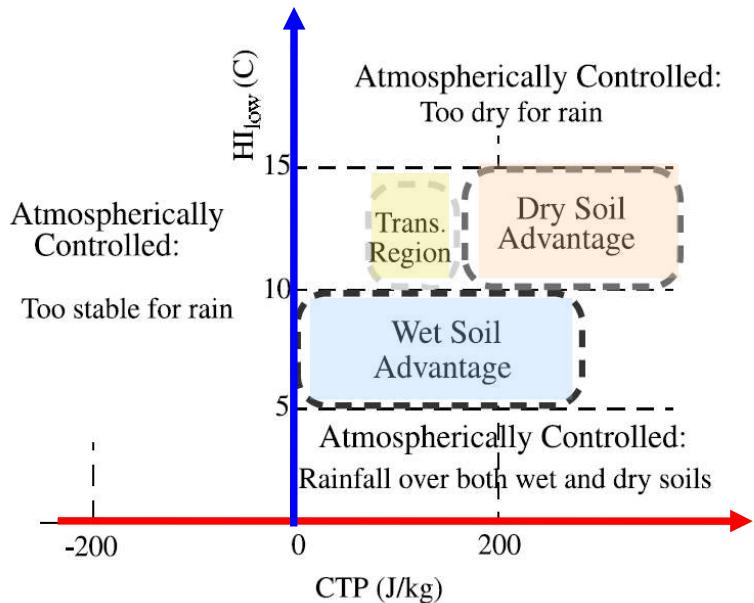
CIN (Convective INhibition)

CAPE (Convective Available Potential Energy)

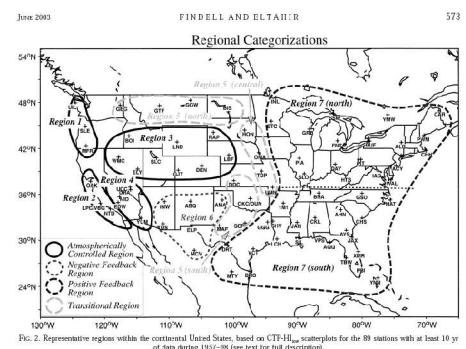
Findell & Eltahir (2003) propose indexes...

- 1) convective triggering potential **CTP**
linked to the [1km,3km] lapse rate dT/dz
- 2) low-level “dryness” index **Hlow**
$$(T-T_d)(Ps-50mb)+(T-T_d)(Ps-150mb)$$

and a framework to look at that

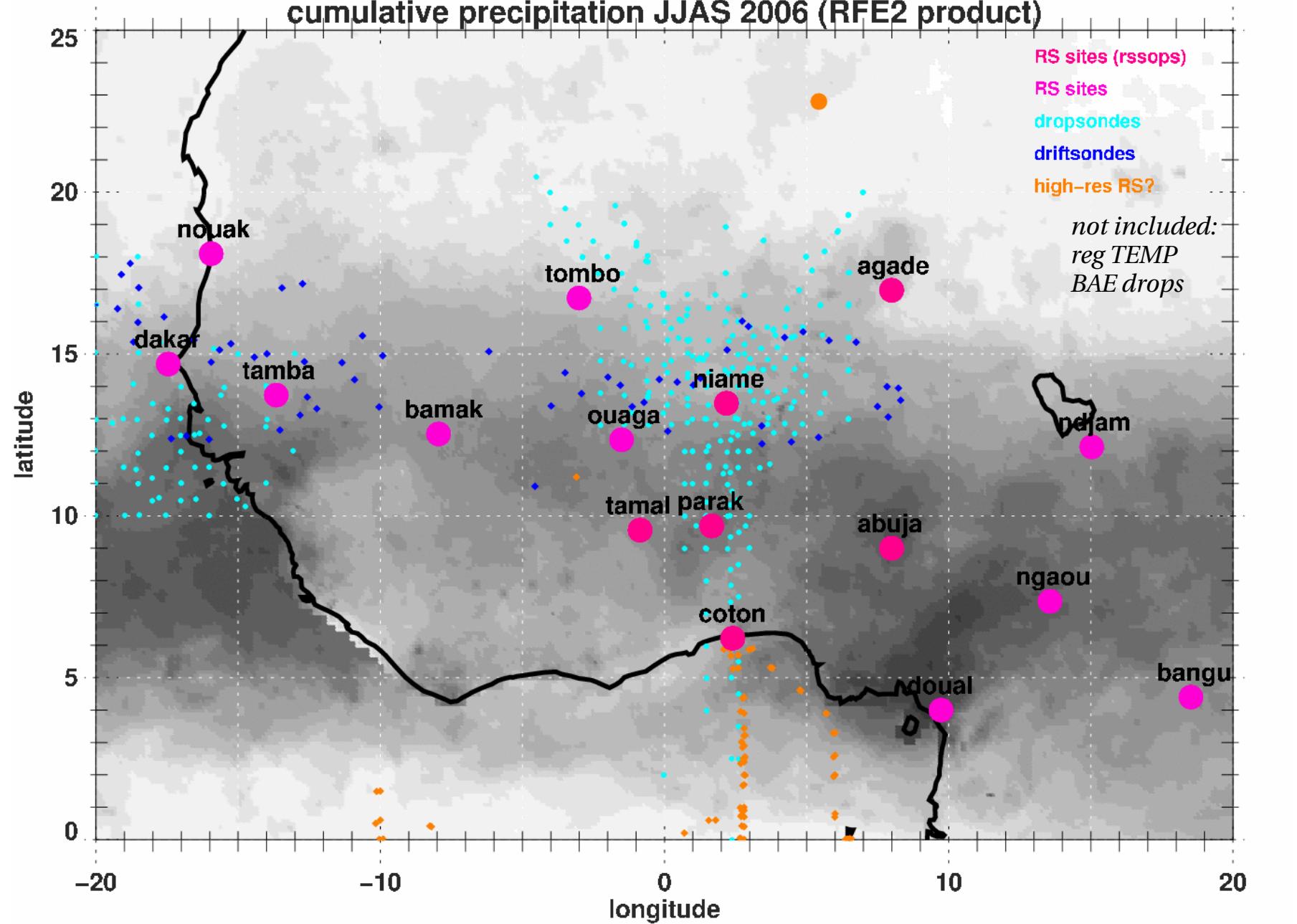


from which
they map
the US
atmosphere

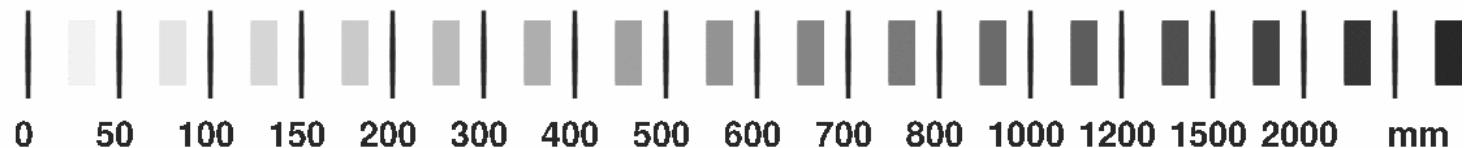


map of high-resolution radio-soundings (RS)

cumulative precipitation JJAS 2006 (RFE2 product)



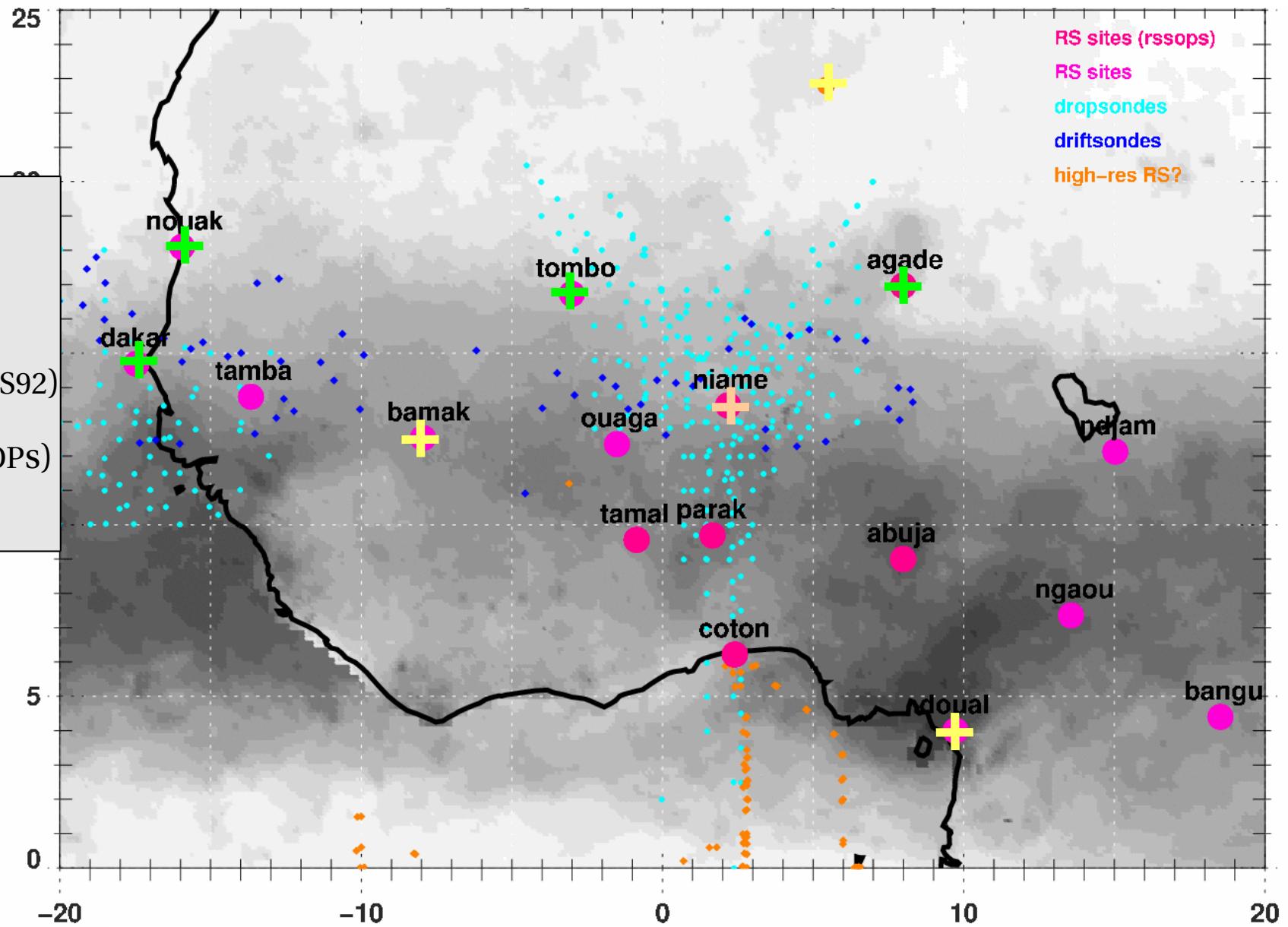
RS network presented
in Parker et al. (2008)



different types of sondes , notably **RS80** in some places/periods, **dry biased!**

RS80

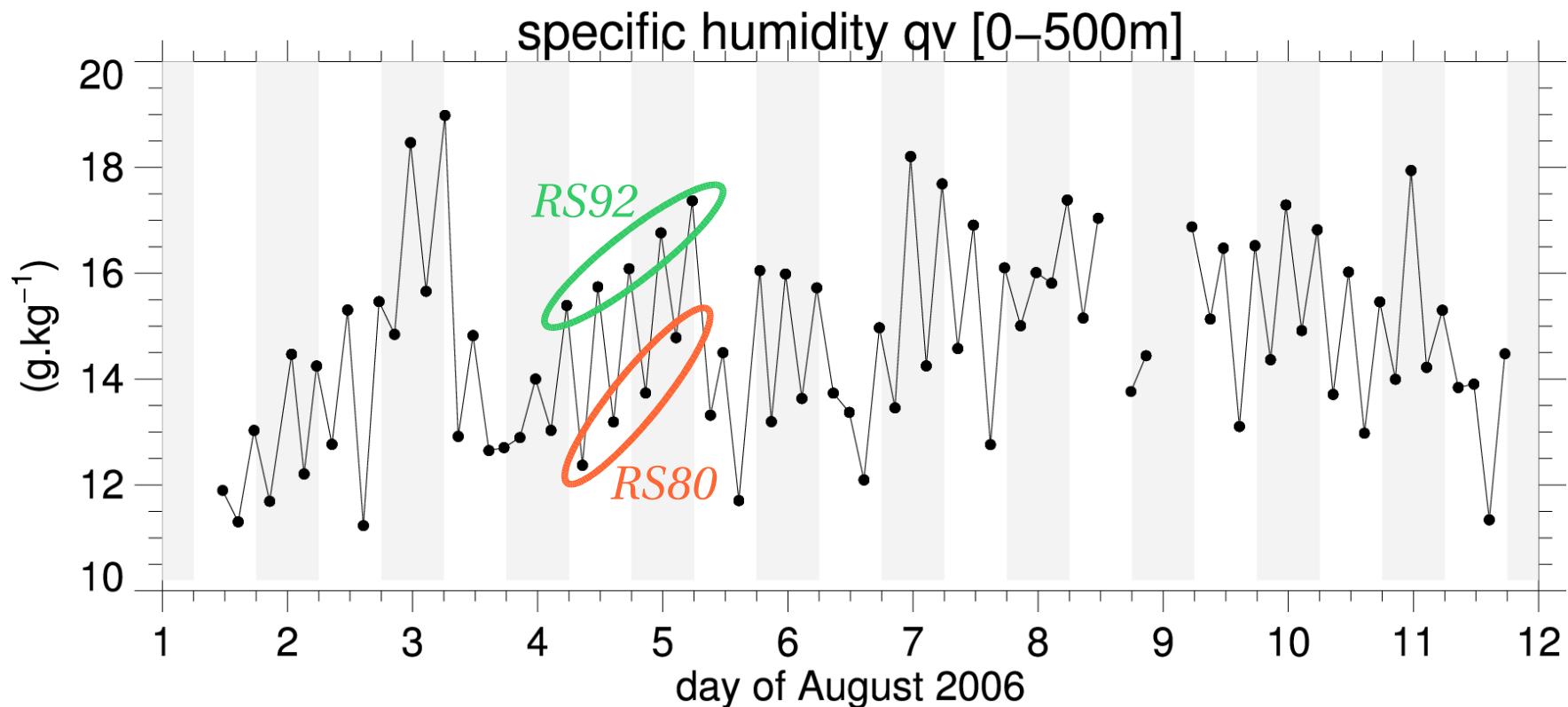
- + only
- + mix (w RS92)
- + a few (SOPS)

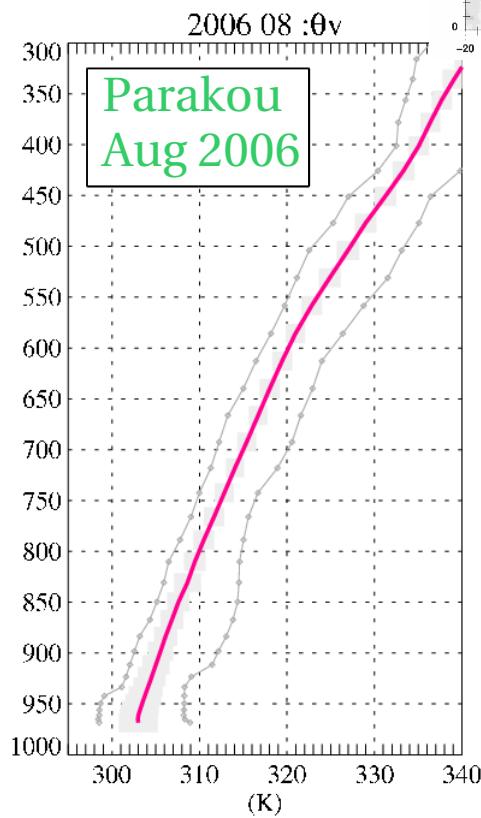
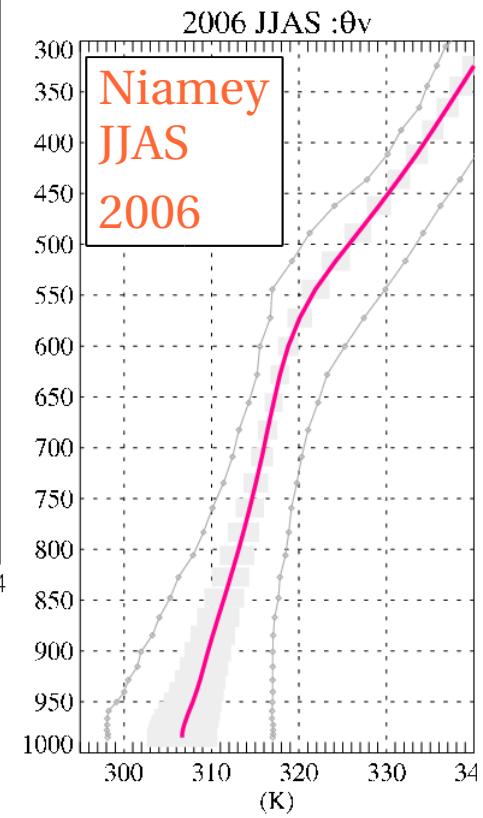
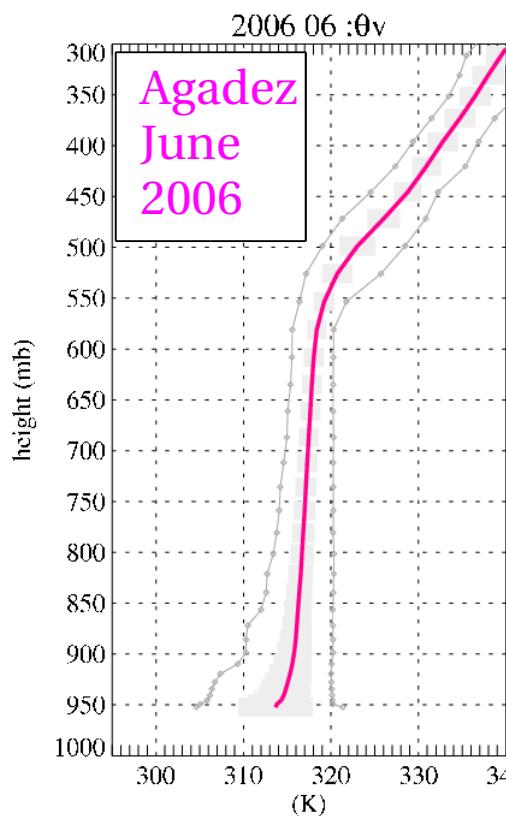


see [poster of Nuret et al. \(XY0016\)](#) for information on humidity bias issues, and for a correction algorithm of RS80 soundings

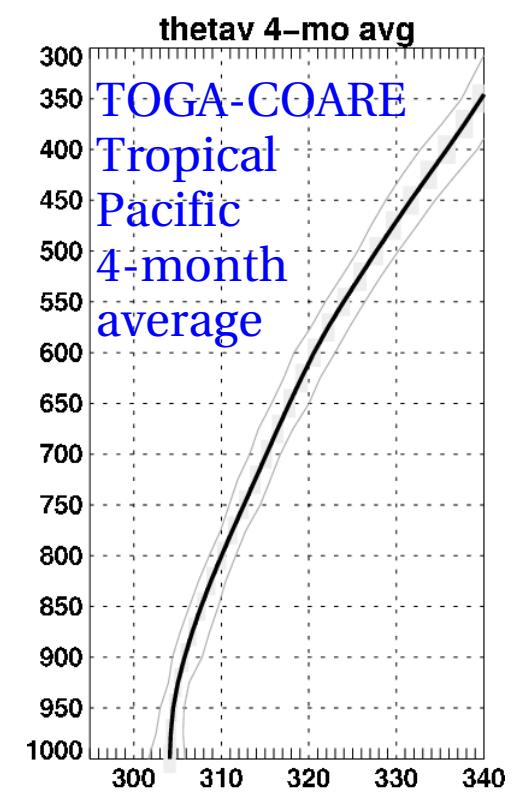
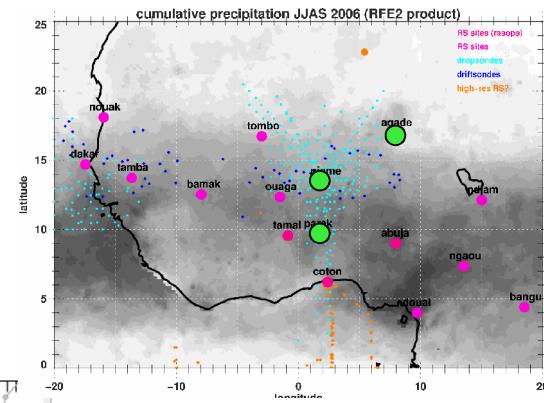
*a glance at the issue from Niamey 3-h August 2006 RS-IOP data...
... revealed by an unusual combination of sounding types adopted for these few days*

time = 0h 3h 6h 9h 12h 15h 18h 21h
 RS92 RS80 RS92 RS80 RS92 RS80 RS92 RS80



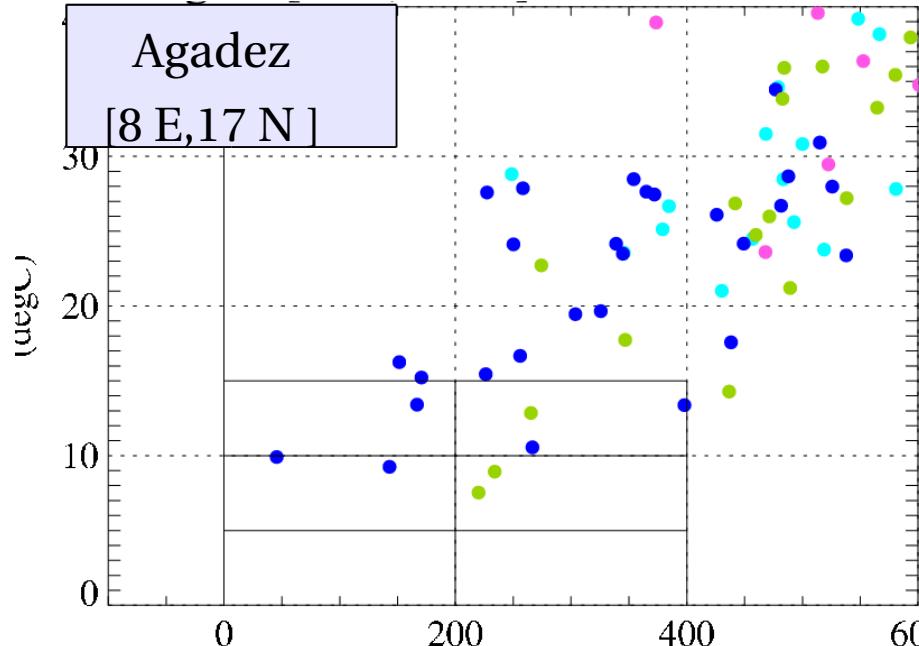


θv at different sites



Agadez

[8 E, 17 N]



June

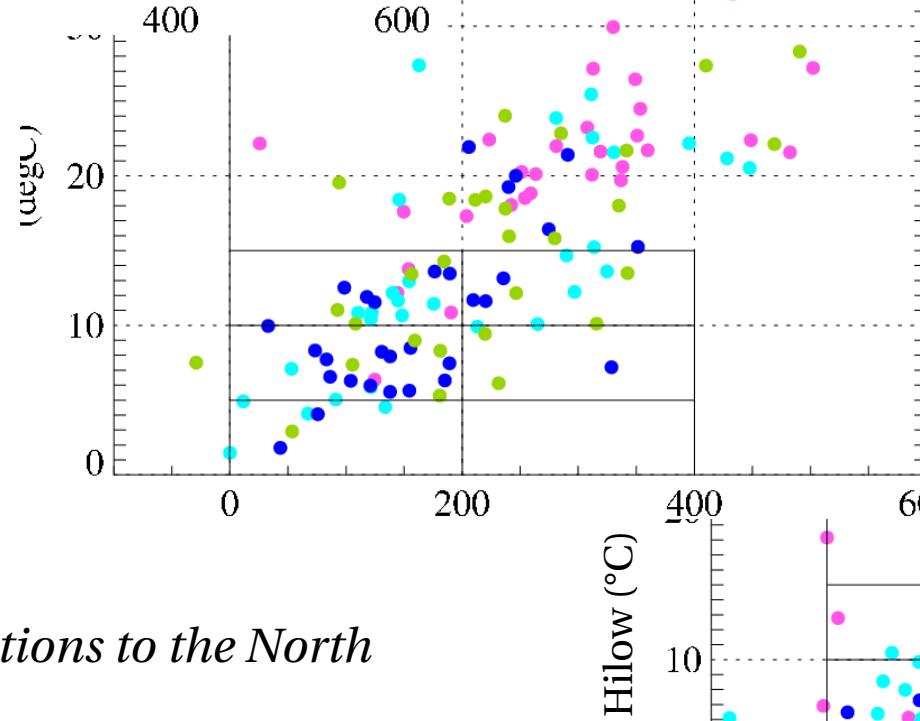
July

August

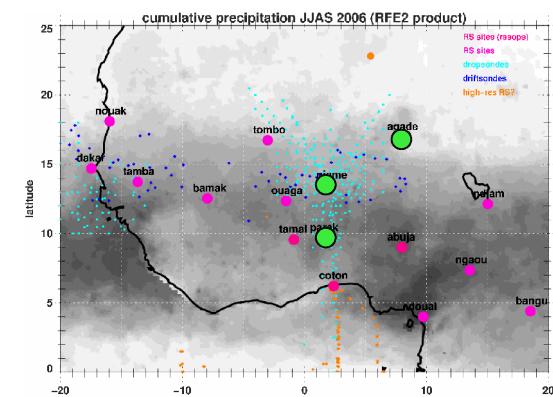
September

Niamey

[2.2 E, 13.3 N]



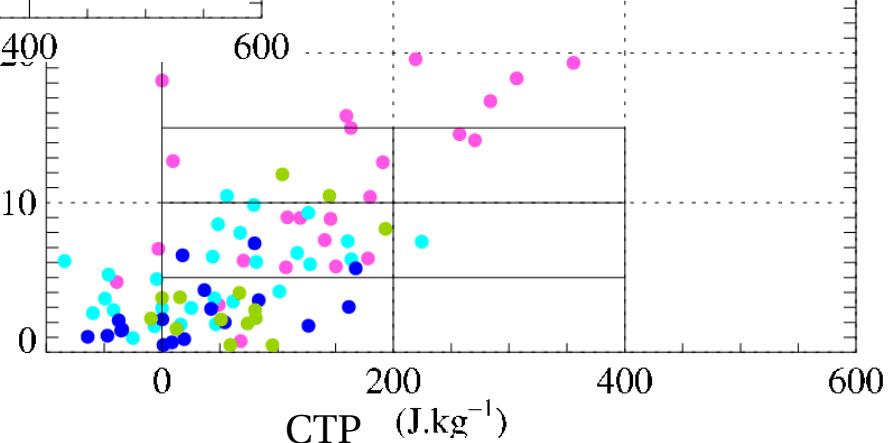
from 6Z sounding data



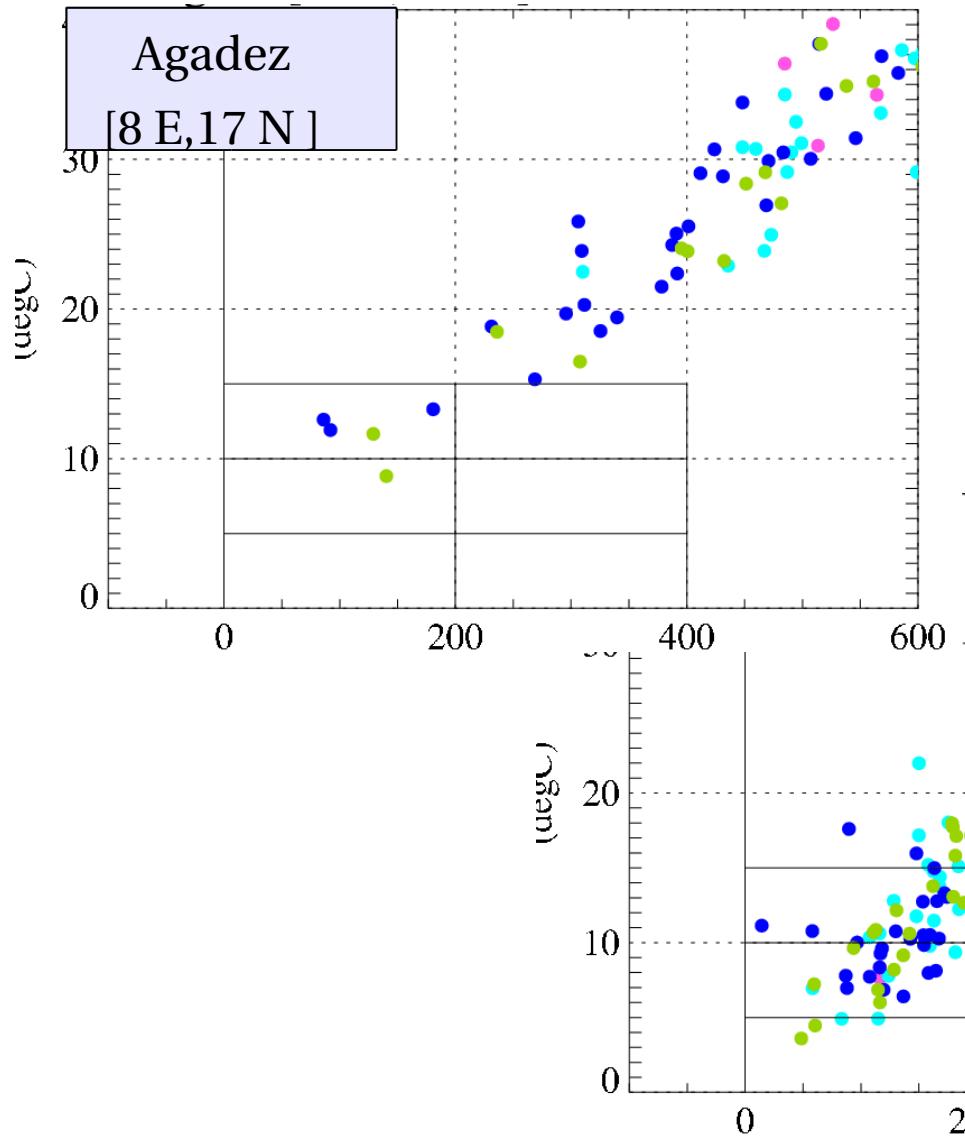
Parakou

[2.3 E, 9.6 N]

Hilow (°C)

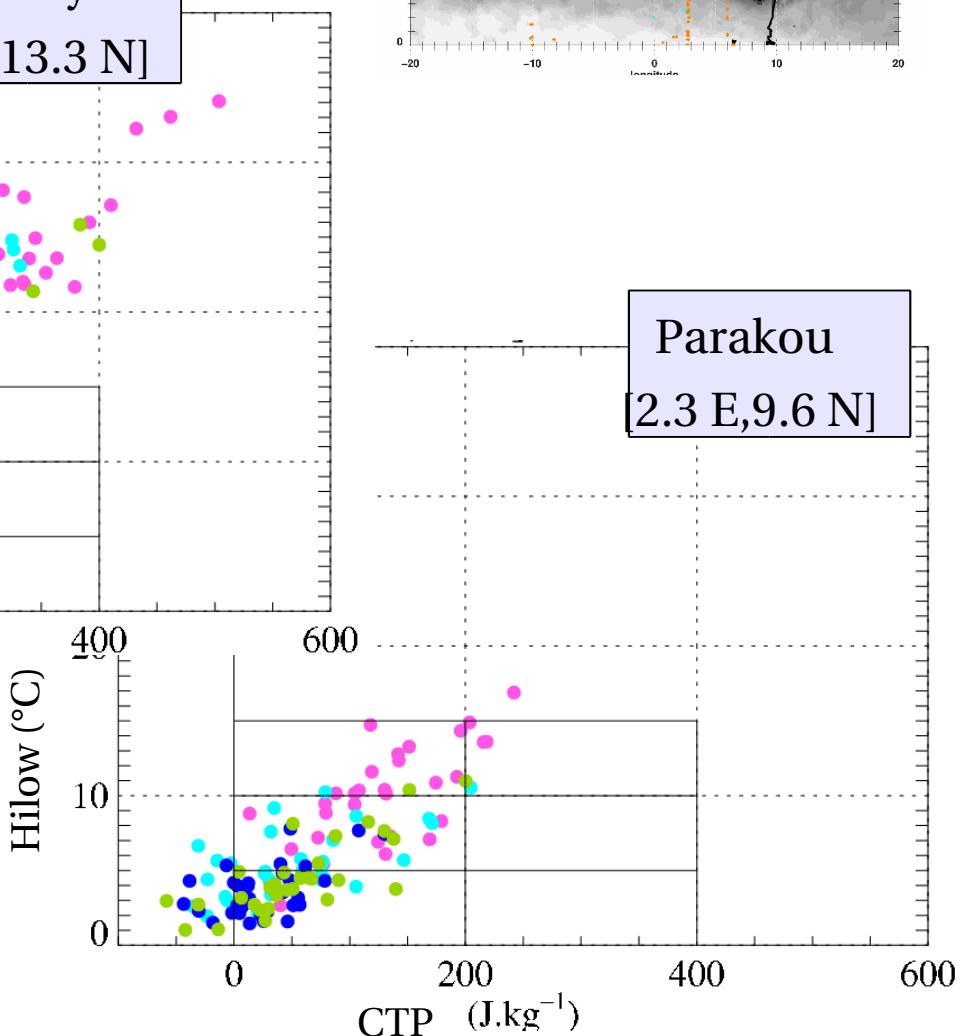


*more day to day variations to the North
seasonal variations
suggests distinct modes of interactions*



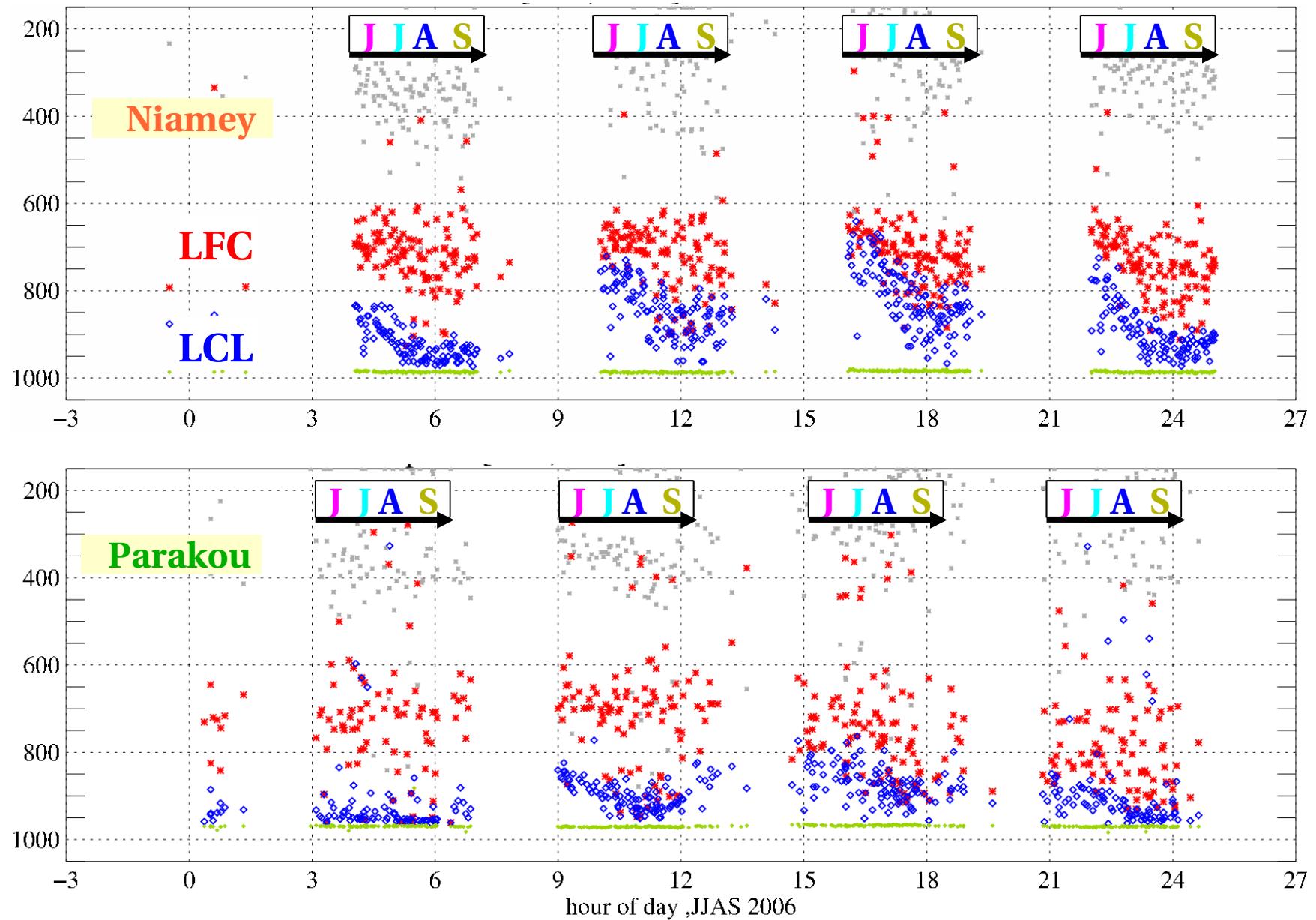
June
July
August
September

from 6Z ECMWF analysis



*these features are captured by the analysis
still some quantitative differences even when
data assimilated & much less scatter*

diurnal and seasonal variations of LCL and LFC



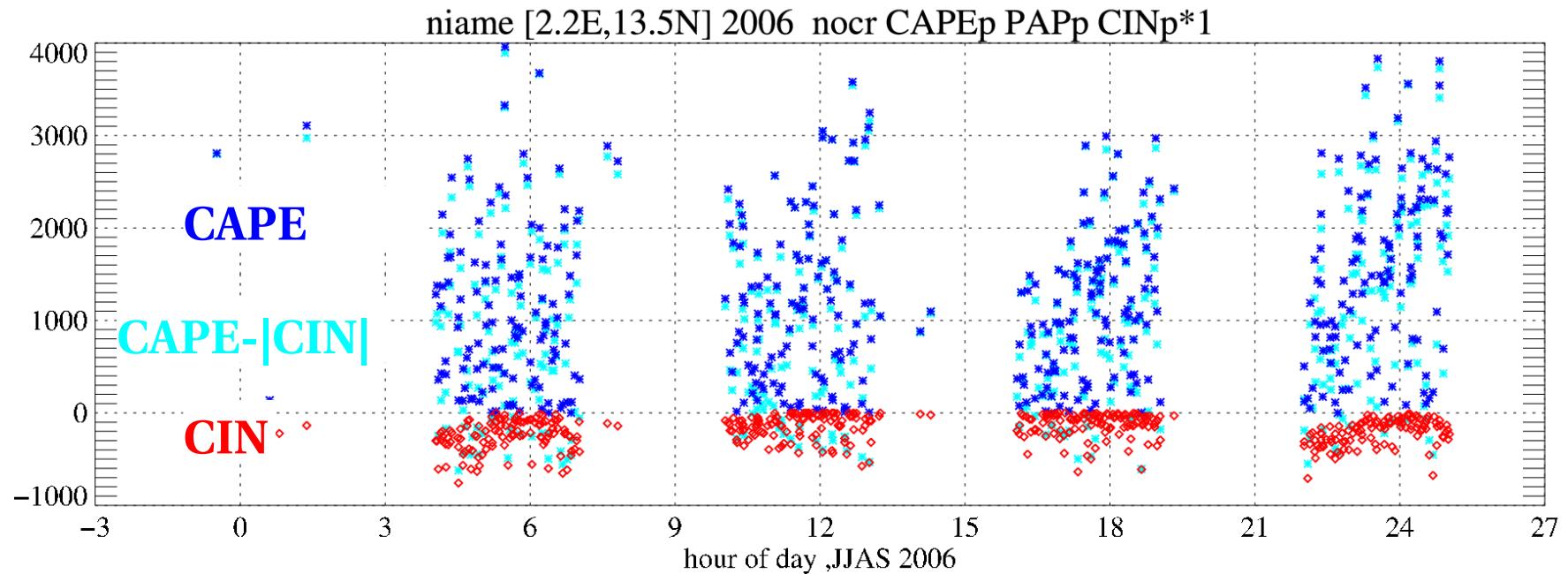
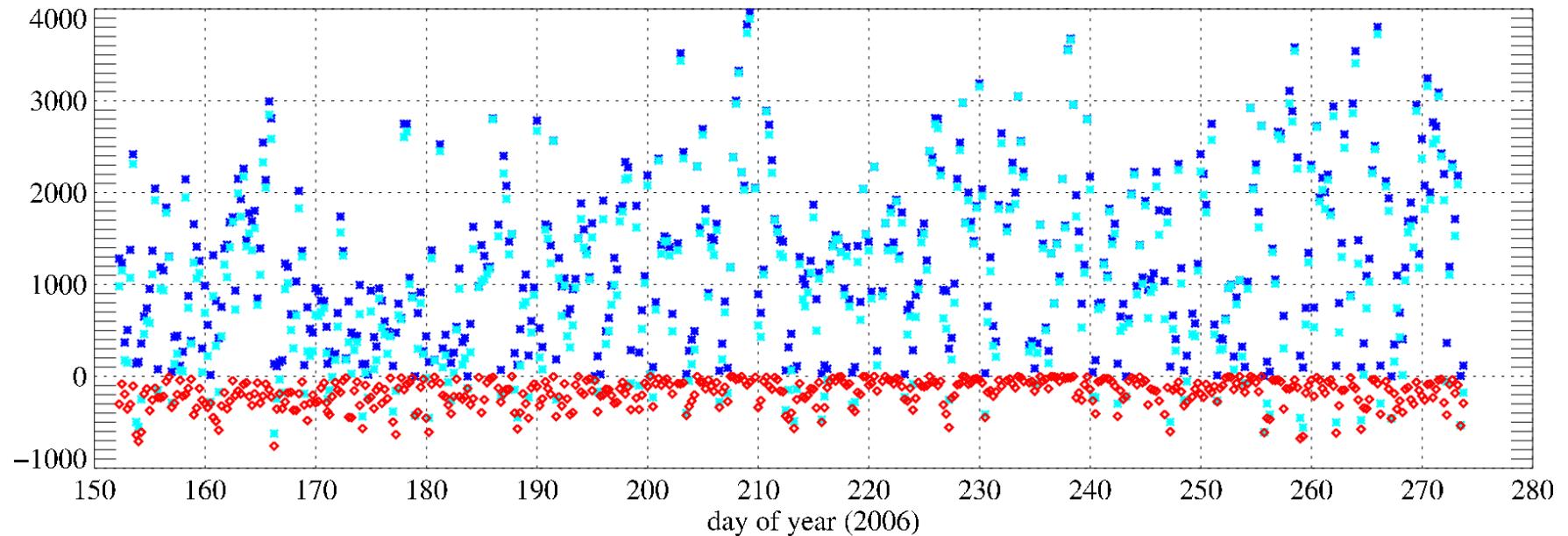
Niamey: strong diurnal cycle of LCL, not of LFC, seasonal shift of LFC

Parakou: weaker diurnal cycle of LCL, diurnal cycle of LFC

how much explained by surface fluxes versus turbulence,advection?

diurnal and seasonal variations of CAPE & CIN

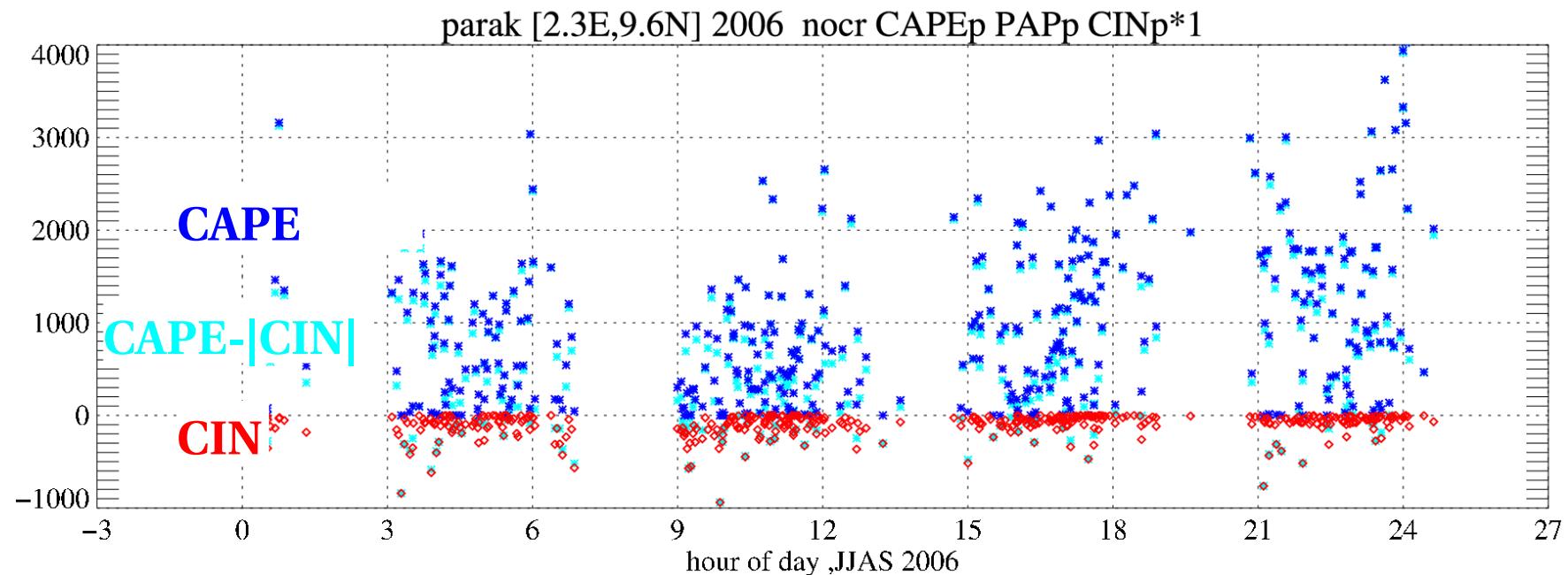
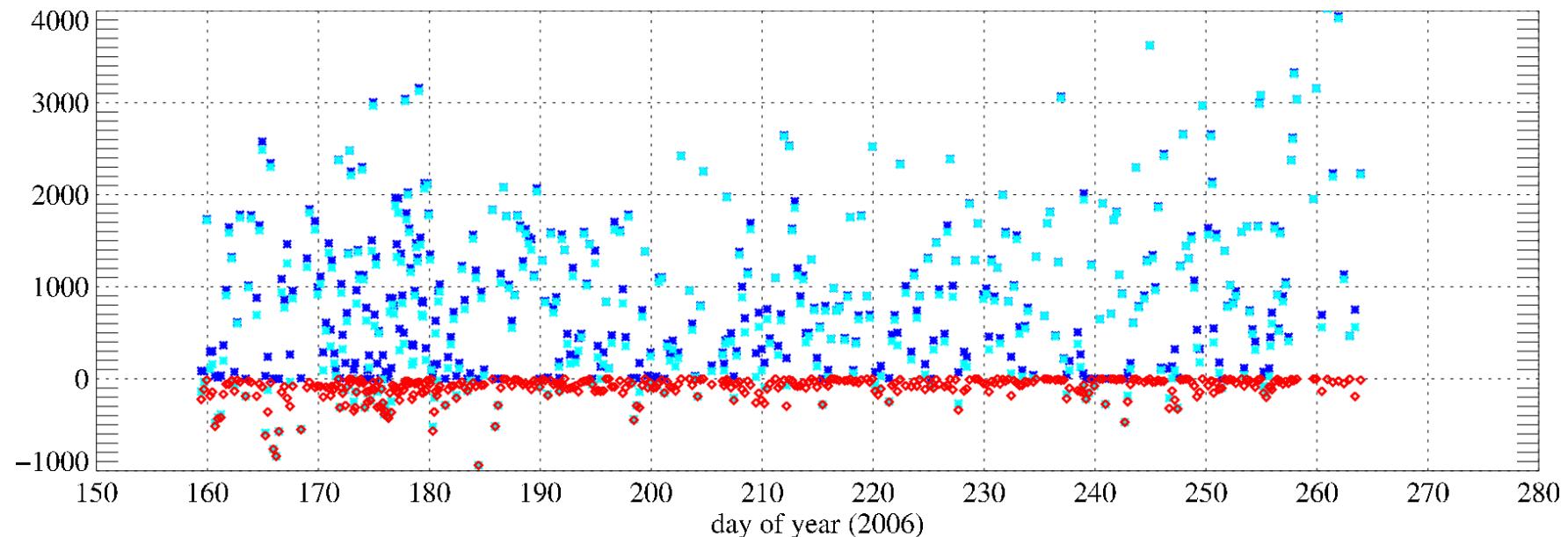
Niamey



high CAPE except end of June, no clear diurnal fluctuations , early season daytime decrease

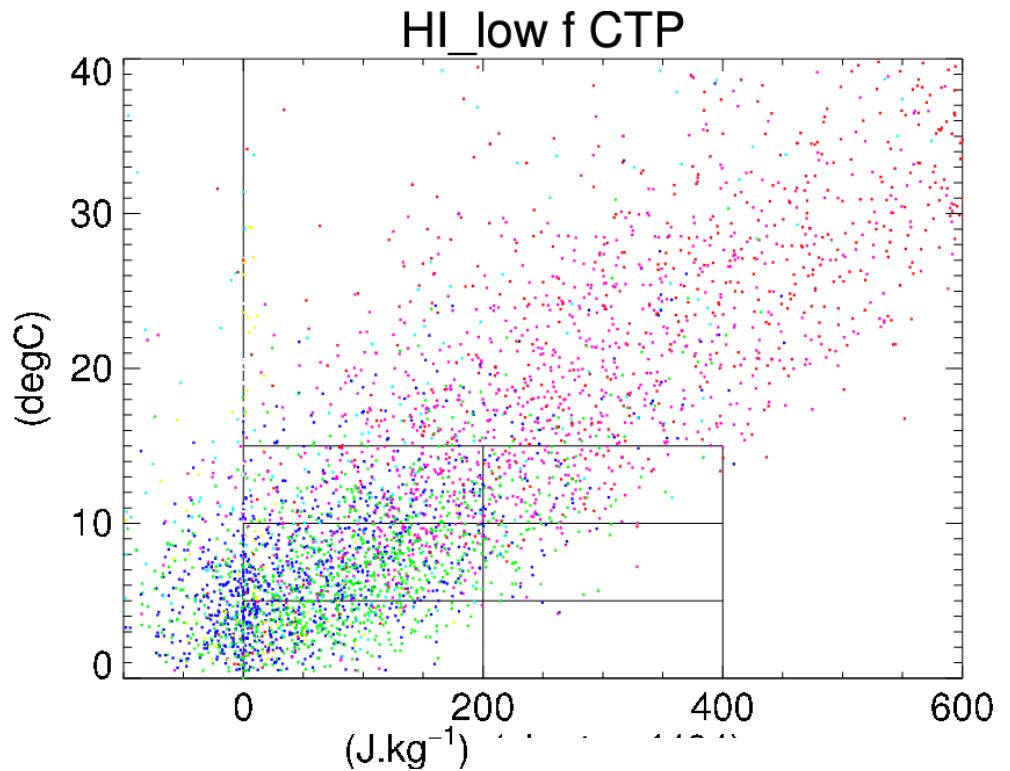
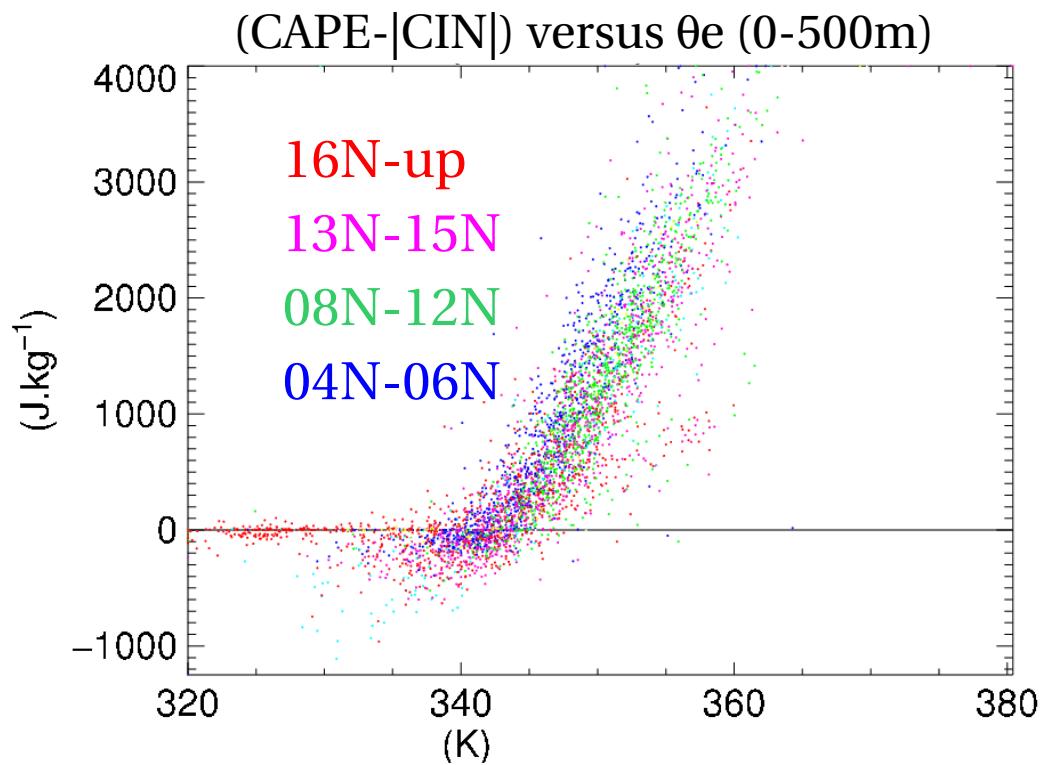
diurnal and seasonal variations of CAPE & CIN

Parakou



higher CAPE in Jun Sep, better defined diurnal cycle, late afternoon max

JJAS 2006, all soundings combined (~3000)



CAPE fluctuations driven by low-level θ_e

Summary

- some quantification from data of the very large geographical and seasonal variation of convection-related parameters and evaluation of its counterpart in analysis

caution needed with RH data, bias issue, poster Nuret et al.

update when RH corrections for other sonde types come

major control of the low levels on convective instability at regional scale

- thermodynamic environment at low levels suggests a variety of modes of land surface -convection interactions; it is also broadly consistent with the idea of *daytime* convection suppressed/favoured over wet surface versus dry ones, depending on latitude and seasonal variations (synoptic fluctuations as well)

observations show that daytime convection is not always favoured over wet surfaces in the Sahel (Taylor & Ellis 2006) and also elsewhere (Findell & Eltahir 2003, Chen and Cotton 2004)

- but how does the thermodynamic environment actually play a role, in reality? i.e. at which scales? and for what?
- how does it combines with other factors, e.g.; turbulence, cloud amount (rad), mesoscale circulations, to explain some aspects of observed situations?
- possibility of further investigation with AMMA data
- modelling: which kind of regimes? do they care?
(additional indexes, e.g.; shear)